Supplement to the manuscript of Högberg et al.:

The SPARC water vapour assessment II: Profile-to-profile and climatological comparisons of stratospheric δD(H_2O) observations from satellite

Preamble

In the main part of this manuscript we distinguish between two approaches to derive a δD product (as an average for example) from a set of simultaneous HDO and H_2O observations, i.e. the "individual" and the "separate" approach. The latter approach is used consistently in the main part of the manuscript to allow comparisons on equal terms, given that the SMR observations do not provide simultaneous observations of HDO and H_2O. Here we use MIPAS and ACE-FTS data, which have simultaneous HDO and H_2O observations, to quantify the sensitivity of the δD results depending on the approach chosen. Section 1 focuses on the profile-to-profile comparisons, Sect. 2 on the comparisons of seasonally averaged latitude cross-sections and Sect. 3 on the comparisons of monthly averaged profiles in the tropics.

1 Profile-to-profile comparisons

Figure S1 shows the bias estimates from the profile-to-profile comparisons of different MIPAS and ACE-FTS data sets using the "inivididual" approach. Compared to the results based on the "separate" approach, shown in Fig. 1 in the main part of the manuscript, both consistent and different features are visible. The most prominent differences can be found towards the lower and upper altitude boundaries where the individual MIPAS and ACE-FTS data sets can be compared with each other. At the lower end the "individual" approach exhibits typically larger biases than the "separate" approach. At the upper end the "separate" approach indicates mostly a negative absolute biases (or positive relative bias) while for the "individual" approach the results have the opposite sign. Also the comparisons among the two MIPAS and the two ACE-FTS data sets exhibit differences in details.

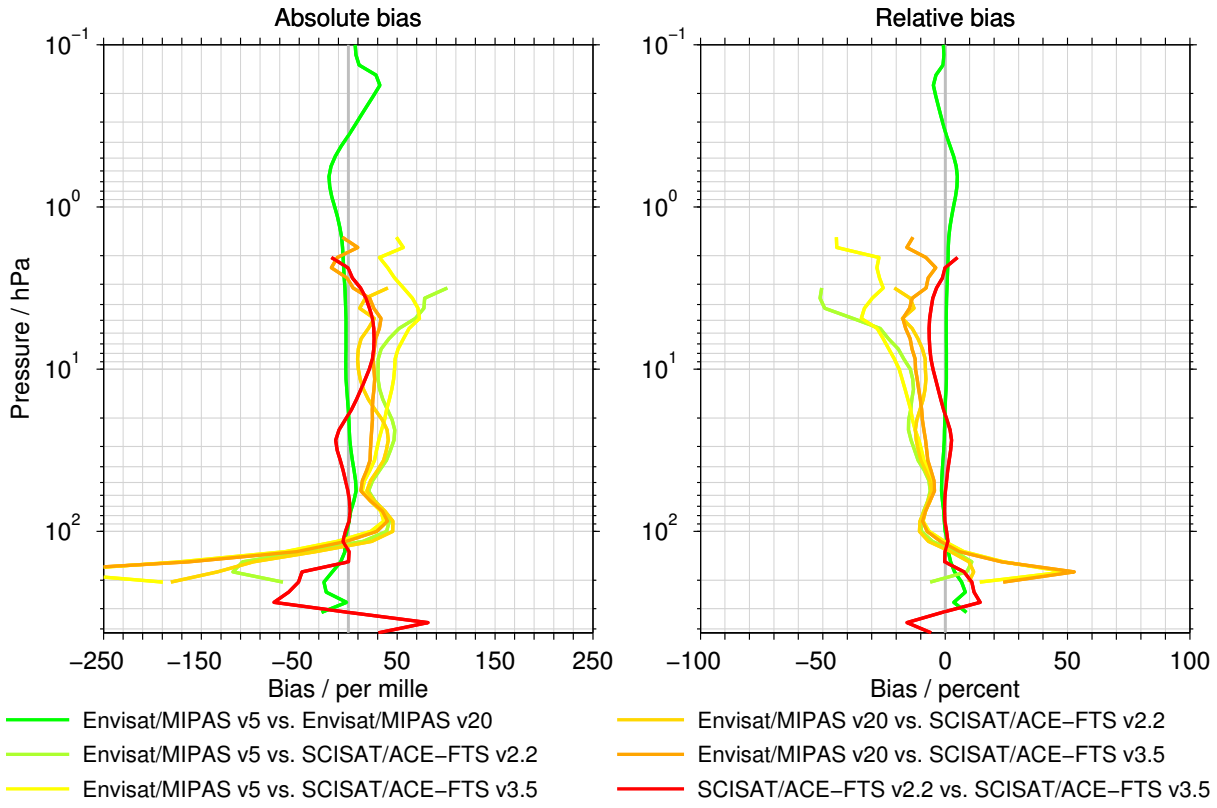

Figure S1: Profile-to-profile comparisons between different MIPAS and ACE-FTS δD data sets based on the "individual" approach. As in Fig. 1 of the main manuscript, which shows the results of the "separate" approach, for the relative bias the x-axis has been reversed for visual consistency with the absolute bias.

2 Comparisons of seasonally averaged latitude cross-sections

Figure S2 shows the differences between the two approaches ("separate" approach minus "individual" approach) for seasonally averaged latitude cross sections at 100 hPa (left column), 10 hPa (middle column) and 1 hPa (right column). These results relate to Figs. 2–4 in the main part of the manuscript, which show the seasonally averaged latitude cross sections based on the "separate" approach for the three pressure levels considered here. Differences can be observed in all dimensions, i.e. season, altitude and latitude. The differences are typically within 10 ‰ with a few exceptions. At 100 hPa those are mostly located in the tropics and subtropics. The largest differences in absolute terms are however found in the Antarctic in JJA amounting to 25 ‰. At the higher altitudes the largest differences occur predominantly towards the polar regions. Overall the differences are smallest at 10 hPa. At 1 hPa the differences are systematically negative, i.e. the "individual" approach results consistently in higher δD values than the "separate" approach at this altitude. At the other altitudes such systematic effect cannot be found and positive and negative differences are about equally distributed.

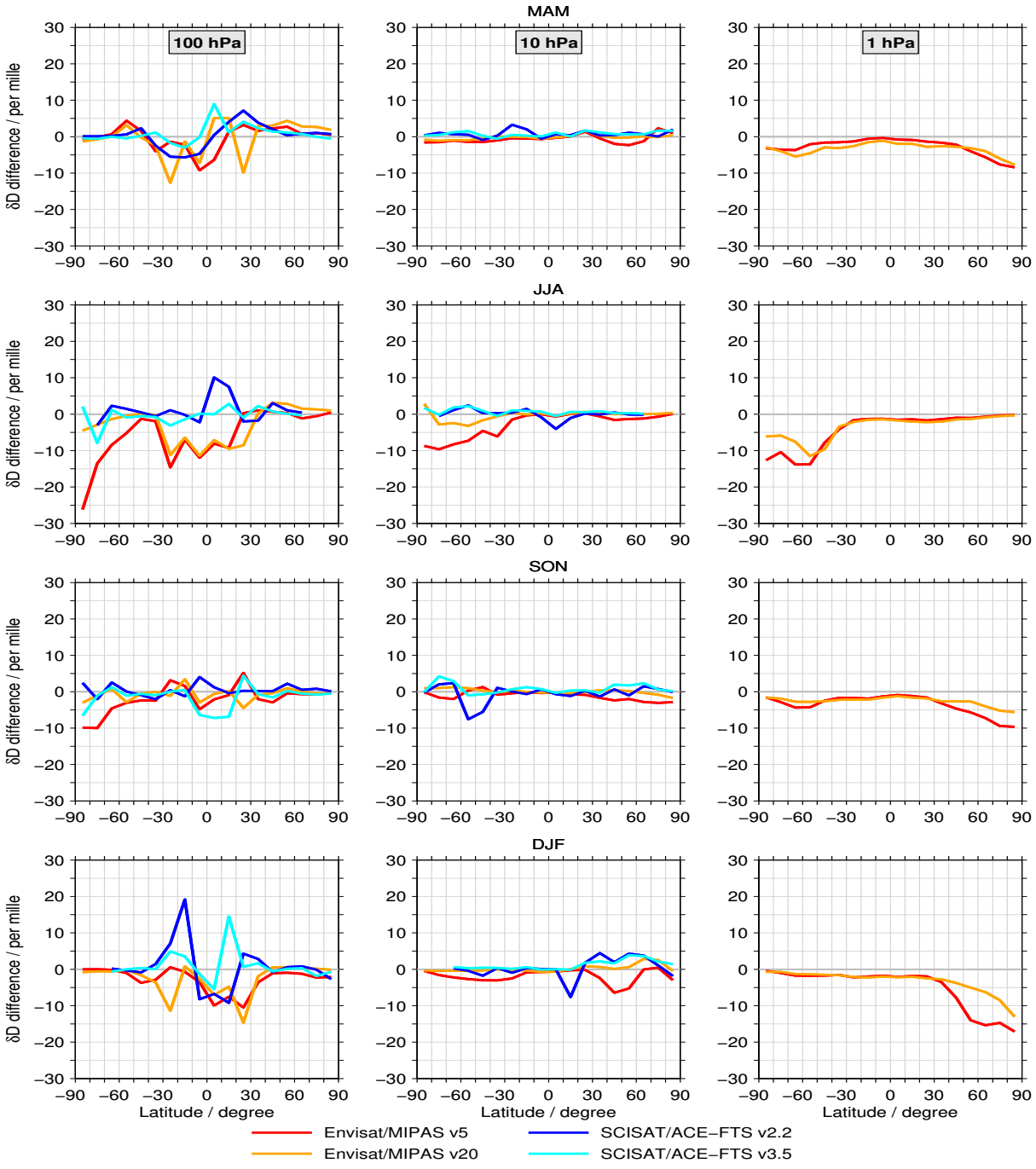

Figure S2: Differences between the "separate" and the "individual" approach for the seasonally averaged latitude cross sections at 100 hPa (left column), 10 hPa (middle column) and 1 hPa (right column).

3 Comparisons of monthly averaged profiles in the tropics

Here we focus on the differences due to the two approaches with regard to the monthly averaged profiles in the tropics, relating to Fig. 8 in the main part of the manuscript. Figure S3 indicates similar vertical structures during all four months considered. Below 100 hPa very often positive differences can be observed, which occasionally exceed 50 ‰. Between about 100 hPa and 50 hPa the situation is the opposite with negative differences in the order of 10 ‰. Higher up the differences are small with a few per mille typically. Just at the upper altitude boundaries of the individual data sets again larger differences between the two approaches can be seen.

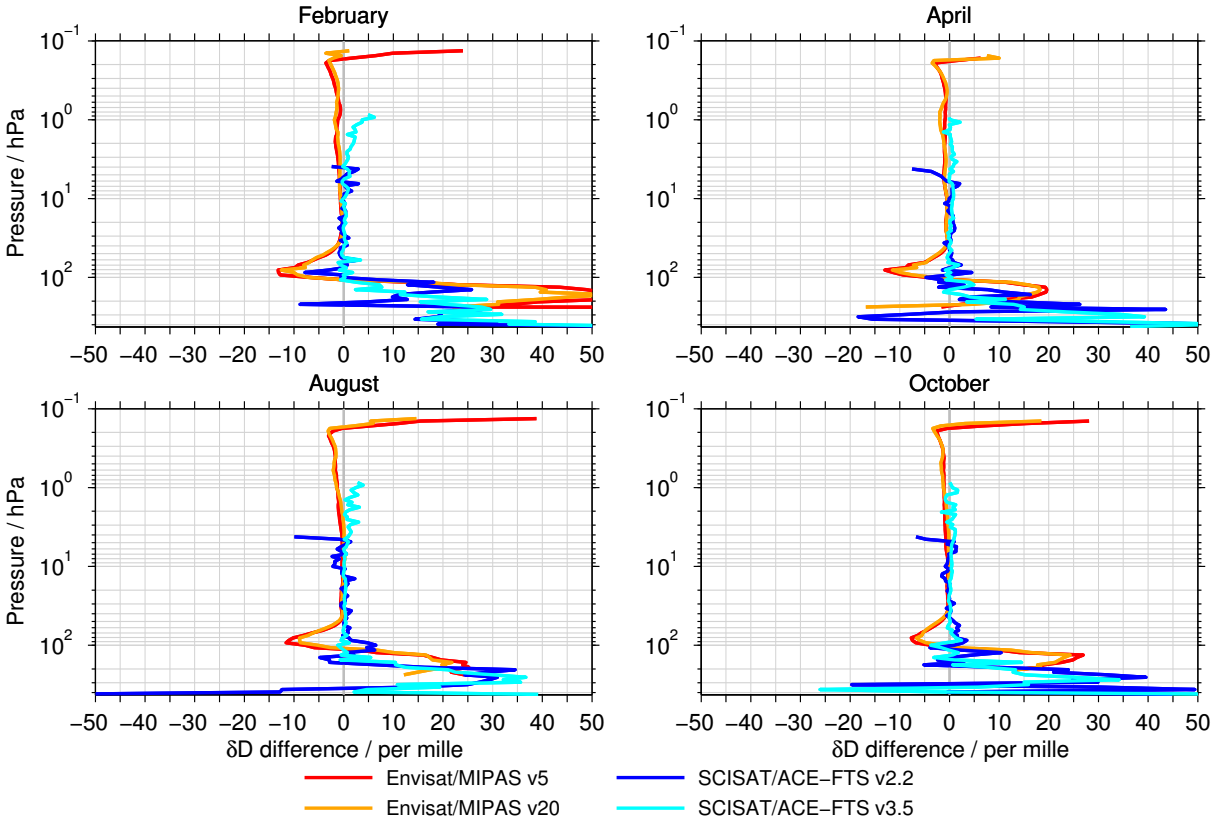

Figure S3: As Fig. S2, but here focusing on monthly averaged profile in the tropics.